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The Custom Milling of Industrial Minerals in B.C.

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A Study of Commercial Feasibility.

STUDY FUNDED BY
THE CANADA - BRITISH COLUMBIA MINERAL DEVELOPMENT AGREEMENT

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1. EXECUTIVE SUMMARY

* This study was initiated after an unsolicited proposal to the British Columbia Geological Survey and is funded by the Canada - British Columbia Mineral Development Agreement.

* The installation of a custom processing facility for industrial minerals in the Province of British Columbia may stimulate non-traditional mineral business and encourage some new value-adding to industrial minerals now produced in the province. This study was undertaken to determine whether such a processing facility could be established on a commercially viable basis in the province.

* A review was undertaken of potential sources of supply and markets for industrial minerals in the province to identify what might become feed material for such a plant. Three custom processing sites were visited in Europe to assess the physical requirements and to obtain opinions of operators as to the potential for success in similar operations in a B.C. location. These operators were polled as to their level of interest in participating in some manner in a start-up operation in B.C.

* The custom processing of industrial minerals involves simple size reduction, classification, storage and packaging. No beneficiation and therefore virtually no waste disposal is undertaken. Site location is typically at a transportation nexus, where water, rail and highway systems join. The European processors can generally supply their customers on a one day delivery basis. An important function of the custom processor is warehousing, acting as an inventory storage close to the consumer.

* The capital cost for a custom plant would be defined by land costs and plant capacity as measured both in terms of tonnage and product range. The general practice requires that mills are virtually dedicated to one product in order to avoid extensive clean-up work or unallowable contamination when switching over to different minerals. A range of capital cost of between $5,000,000 and $10,000,000 would be expected for a fully integrated multi-product operation.

* Such a plant might generate annual operating revenues in the range of $1,000,000 to $15,000,000 depending on the type of processing carried out. The higher operating revenues would include a proportionately higher operating cost and reflect the very wide range of product price that may be obtained.

* The decision to establish or sponsor a new custom processing facility for industrial minerals must be made in context of the markets that can be served by that particular location. The custom processor will require a sufficient base load of product

passing through the plant to support the cost of land and investments and fixed costs related to the operation. A custom processing plant will not be able to carry out beneficiation of low purity minerals commercially unless all waste product is saleable as by-product and can support raw material freight costs.

* It is not obvious, at this time, that British Columbia has suitable sources of supply of industrial minerals or sufficient market linkage to establish a custom milling facility on a commercial basis. However, there is good potential for developing a processing industry based on the transportation linkage now in place and serving the Pacific Rim markets.

* In considering locations in the province that might be suitable for a plant site, a tidewater site in the Port of Vancouver area was a logical selection. Although the local sources of supply and markets for industrial minerals may have some limitations, the possibility exists for developing international trade around the Pacific Rim. Empty bulk shipping returning to Vancouver for bulk materials and empty containers leaving Vancouver that could carry value added materials to Pacific Rim markets, could offer substantial delivery advantages despite the large distances that the products might travel.

* All the European processors visited expressed at least initial interest in a joint venture participation in establishing a custom processing plant, possibly using technology transfer as part of their contribution to such a joint venture. A successful custom milling facility will require not only credible technology but also an ability to access the local and Pacific Rim markets available. There could be useful synergy in a joint venture approach.

2. INTRODUCTION

Discussions in 1987, between Federal and Provincial Government agencies involved in regional development programmes, led to consideration of the concept of the establishment of a custom processing plant for industrial minerals as a means of stimulating non-traditional minerals business. A problem perceived for the small industrial minerals producer was that the relatively high capital cost of a processing plant was usually too much of a financial burden during the start-up period when the producer is developing markets.

The availability of a custom processing plant was thought to offer encouragement to the development of local resources to supply both local and possibly export markets. Potentially, that availability might allow a small producer to develop his markets to a level that could allow him to operate on a stand-alone basis. EMR and CanMet personnel carried out some follow-up evaluation of the concept, including field visits to custom processing plants in Europe. The writer was contracted by the Ministry of Energy, Mines and Petroleum Resources of the Province of British Columbia to review the current practice in custom milling of industrial minerals, particularly as conducted in Europe. This review was to be carried out jointly with a study into the range of industrial minerals that might be treated in such a plant in British Columbia and the order of magnitude economic parameters that might pertain to the operation.

This study was initiated by an unsolicited proposal to the British Columbia Geological Survey and is funded through the Canada - British Columbia Mineral Development Agreement.

In March 1989, a site visit was completed at three European custom processors, one in Britain and two in Holland. Discussions were held with EMR and CanMet personnel who had carried out some studies on the topic and who had also visited, as Federal representatives, European custom processors and equipment manufacturers. Discussions have also been held with British Columbia Geological Survey personnel and some industrial minerals producers in the province, in order to confirm the provincial setting of the study.

This report will outline the similarities and differences of structure between the European operations visited and will describe the limitations and potentials for custom processing in a B.C. location. Recommendations are made as to the types of minerals/products that would be reasonable to consider for processing and the markets that have potential for access by a B.C. producer/processor.

3. CUSTOM PROCESSING OF INDUSTRIAL MINERALS - EUROPE

3.1. Structural Outline

Three custom processors of industrial minerals were visited in Europe, and while these may have represented a limited sample of European operators, they do cover a wide range of products. Each has arrived at its present day configuration by quite distinct routes. Their underlying business approaches are distinct and each company has developed to its present corporate shape partly because of the circumstances of the development of their businesses.

The companies were Jan de Poorter B.V. (JDP) and Eggerding & Co. of the Netherlands, and Colin Stewart Minerals (CSM) in N.W. England. Of these, Eggerding, was the only company that processed soley for customers and whose income was derived essentially from processing and warehousing charges. Both CSM and JDP act as traders and vendors of value-added products, in addition to carrying out custom processing.

All three companies were located on canals with access for a minimum 1000 tonne bargeload. Eggerding has the additional capacity to receive Panamax vessels. Other transportation linkage was good and an important part of the rationale behind the plant location.

Each company tended to cover different areas of activity in custom processing with some overlap both in processing and products/minerals. The basic functions of each operation were warehousing, comminution, classification and packaging. No beneficiation processing was carried out at any of the sites and waste produced by operations could be contained in a standard commercial dumpster, for later removal to a conventional landfill disposal site.

There was considerable effort made at each operation to keep different minerals separate, both in the warehousing and in the processing, in order to avoid cross contamination. Additional processing such as blending, surface treatment, drying or agglomeration was carried out at some sites. The range of product for each company is indicated in the tables that follow this section.

Eggerding & Co. started life as a warehousing company. The company noted that customers were asking for their product to be sent for size classification and packaging. The processed material was then being returned for storage in the same warehouse location. Subsequently, this processing was recognized

as a further business opportunity for the company. With Eggerding carrying out the processing the storage customer enjoyed a considerable saving in handling and freight costs, while giving the company the benefit of the margins available from the custom processing activity.

No dark minerals are processed at the site in order to avoid cross contamination and possible waste production. Some dark minerals, such as chromite are warehoused near light coloured minerals if a common owner/client requests this. Analytical capability for quality control is limited to particle size determinations, since the customer delivers product at his specification.

The dry storage capacity on site is approximately 120,000 tonnes, depending on bulk densities. The current milling capacity of their operations is approximately 100,000 tonnes per annum. Processing capacity in terms of tonnage can vary widely according to whether the products are fine ground or coarse ground and according to the work index of the minerals being processed. The company tries to use separate mills for different minerals to avoid contamination and/or clean up costs required with a changeover. Five mills are currently operating and two new mills are under construction.

Jan de Poorter B.V. was founded in 1937 as a trader and agent for ores, minerals and chemicals, with a particular emphasis on products for the glass, ceramic, refractory, and foundry industries. In 1971, the company became a subsidiary of S.C.R. - Sibelco N.V. of Antwerp and Quarzwerke GmbH of Frecken. The company has three divisions operating at its Geertruidenberg location; an international trading company, dealing with many of the minerals that are processed at the site, a producer of fused silica and other fused minerals, and the basic mineral processing company.

The mineral processing company carries out a much wider range of process steps than Eggerding & Co. Because the company is trading, and not just handling client product, shipments are thoroughly sampled and assessed before being loaded in the country of origin. Also, the company operates a substantial chemical and physical properties laboratory at the Geertuidenberg site for the testing of both incoming and outgoing shipments.

The company processes both light and dark minerals at the same site but with each group of minerals clearly separated by physical barriers to prevent cross contamination. One specialty area covered by the processing arm of Jan de Poorter is the preparation of ready to use clay mixtures and pigments for the ceramics and refractories industries.

The Geertruidenberg site has dry storage capacity of approximately 80,000 tonnes, depending on bulk densities, and milling capacity for approximately 200,000 tonnes per annum.

Colin Stewart Minerals Ltd has been operating as an industrial minerals supplier and custom processor since 1968. During the last deep recession, there was some consolidation of the smaller custom processing companies in Britain, and CSM went through some reorganization at this time. The company joined the Benjamin Priest Group plc in 1986 and has continued to expand its activity as a trader, processor and supplier of industrial mineral products.

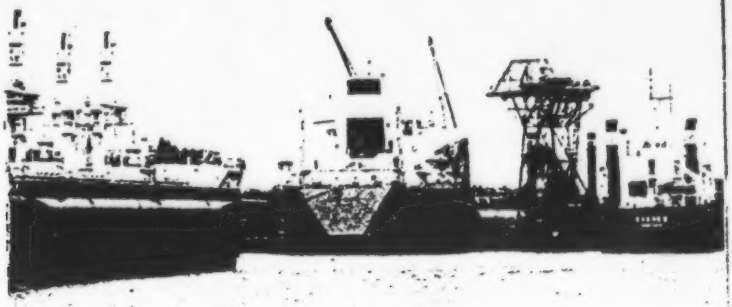
Like Jan de Poorter, CSM carefully samples and assesses shipments before loading in the country of origin. The proximity of the Winsford plant to laboratories at ICI Ltd and university and other industry laboratories in the area, has allowed CSM to avoid the high cost of a full service laboratory to support its quality control.

Both light and dark minerals are processed by the company. The problem of cross contamination is considered so severe that, as far as possible, the two groups are treated at different plant sites. The company targets the higher value added products, such as advanced structural fillers for plastics, which carry a higher profit margin and utilize the advanced technology that has been developed on site. Surface treatment, blending and mixing, and agglomeration are process steps that often result in the higher value added product at the Winsford, Cheshire, site.

The dry storage capacity at Winsford is in the order of 40,000 tonnes with adequate space for expansion on the site. The combined capacity of the processing plants is approximately 200,000 tonnes per annum. Actual production in 1988 amounted to about 160,000 tonnes.

Another type of custom milling facility noted in Europe was the large company subsidiary, such as the Fordamin division of English China Clays plc. That company does some custom processing as a small profit centre that is supplemental to its principal business.

Table 1. PRODUCT LISTING -



coenhaven - amsterdam
holland

Address:

Westerhoofd 12,	*1013 BS Amsterdam*
Postal Address:	*P.O. Box 8224,*
	1005 AE Amsterdam
Telephone:	*(0)20 - 840701/846330*
Telex:	*14208 eggco nl*
Telegr. address:	*Easy shipping*

Mineral	Principal End Use
Aluminium-calcium silicate	Desulphurizing steel
Calcite	Filler
Caustic Magnesite	Cattle Feed
Chromite	Refractory
Fluorspar	Acid Grade
Petalite	Ceramics
Rutile	Opacifier/Pigment
Spodumene	Ceramics
Zircon	Ceramics/Welding Rods
Talc	Pitch control/Filler
Wollastonite	Structural Filler/ Asbestos substitute

JAN de POORTER PRODUCTS WITH THEIR APPLICATIONS IN VARIOUS BRANCHES OF INDUSTRY .

TRADE NAME	BRAKE LININGS	CASTING POWDERS / STEEL REFINERY	CATTLE FEED	CERAMICS	CHEMICAL & FERTILIZER INDUSTRY	CIVIL ENGINEERING	COARSE CERAMICS	FERRITES	FOUNDRY MOULD MATERIAL	GLASS-, FIBRE-, WOOL, GLAZES, ENAMELS	GRIP-IMPROVING ROAD SURFACING	OIL AND WATER WELL DRILLING	PAINTS & POLYMERS	RADIATION SHIELDING CONCRETE	REFRACTORIES	SCOURING & POLISHING MEDIA	WELDING ELECTRODES	MINERAL
CARBOFER					●													SIDERITE
CASIFLUX	●	●		●				●		●			●				●	WOLLASTONITE
CHROMITE SAND									●						●			CHROMITE
COLCLAY/PORTACLAY				●	●	●			●	●		●	●		●		●	BENTONITE
MELAVITE			●															BENTONITE
MANGALOX				●	●		●	●		●							●	MANGANESE DIOXIDE
MICROFER				●			●											IRON OXIDE
PORTABOR				●	●		●			●			●	●			●	BORON MINERAL
PORTACHROM	●			●	●		●			●					●			CHROMITE
PORTACOLOR							●						●					IRON OXIDE
PORTADOLOMITE				●	●					●		●	●			●	●	DOLOMITE
PORTAFER				●			●	●	●	●		●				●	●	IRON OXIDE
PORTALUM				●			●				●		●		●		●	CALCINED BAUXITE
PORTALUSITE															●			ANDALUSITE
PORTANIT				●						●						●		ANORTHOSITE
PORTAPHYLL				●					●				●		●		●	PYROPHYLLITE
PORTAREF				●					●						●		●	CALCINED DIASPORE
PORTARYTE	●									●		●	●	●				BARYTE
TALCOPORT				●	●								●		●		●	TALCUM
VITROFLUX		●		●						●			●		●		●	LI.-ALU. SILICATE

Comprehensive data sheets on product grades, with chemical and physical data are available on request.

Typical products and markets served

	Adhesives	Animal Feeds	Chemical Manufacture	Ceramics	Civil Engineering	Construction Industry	Cosmetics	Detergents	Fertilisers	Foundry	Ice Clearing	Mastics	Paints	Pharmaceuticals	Plastics	Potteries	Refractories	Road Surfacing	Snow Clearing	Welding Rods	Well Drilling	Wine Fining
Andalusite				●												●						
Barytes:																						
Rutenia acid washed	●			●									●		●							
Natural white	●			●									●		●							
Off-colour	●												●		●							
Bentonite clays:																						
Conquest "wyoming"	●	●		●	●			●		●		●	●	●		●	●			●	●	●
Quest standard	●	●		●	●			●		●		●	●			●	●			●	●	●
Quest white	●			●				●				●	●	●		●						
Calcined bauxite				●						●							●	●		●		
Calcined diaspore																	●					
Calcined flint clay																	●					
Clays – kaolinitic																						
Questbond 3		●		●	●				●	●												
Questbond 10				●													●					
Questbond 601				●					●								●					
Fluorspar:																						
Acid grade 97.2% CaF_2			●																	●		
Graphites:																						
Amorphous										●							●					
Flake										●							●					
Magnesites:																						
Calcined		●	●						●													
Dead burned																	●					
Mica scrap/powder						●						●	●		●							
Quartzite																	●					
Red oxide – natural						●							●									
Salt		●							●		●								●			
Talc – white				●			●						●		●							

Colin Stewart Minerals

Colin Stewart Minerals Ltd.
Baker Sillavan Ltd.
Haichen Talc Ltd.
Guangxi Talc Ltd.
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4. CUSTOM PROCESSING OF INDUSTRIAL MINERALS - EUROPE

4.1. Operations

The minimum operation is warehousing. Product, either for a client or for trade purposes is discharged directly from boat or barge at dockside, typically using a grab crane onto the dock for later movement by front end loader, or into a hopper feeding a small mobile conveyor system to load in bulk into the warehouse area. Some mineral product is delivered in Big Bags, a large woven fibre bag of 1-1.5 tonne capacity that can be moved by fork lift truck.

In some circumstances, the discharge of ocean-going vessels into smaller barges and coasters, used for canal shipment, is less convenient than direct discharge at a nearby deep sea port into trucks for a short road haul to the storage area. Rain may stop the discharge of mineral if it impedes materials handling or adds moisture to some products.

The inventory storage function of the industrial minerals processor is very important to the client/customer. This encourages the siting of the processing plant and storage near the point of use. CSM can reach virtually all points in England Scotland and Wales in one day by truck. Similarly, most of the Benelux and Ruhr markets can be served from the Netherlands sites of Eggerding and Jan de Poorter in about one day.

The next level of processing is simple packaging. This might involve loading Big Bags from bulk stocks or conveying product to a hopper and bagging plant. The cost of unskilled labour in Holland is relatively high at about $20 per hour including all social benefits charges. Skilled labour rates are not much higher so there is a considerable desire to use automated systems as much as possible. One skilled operator can cover two mills if the bagging equipment is automated.

Comminution and particle size classification appear to occupy most of the plant capacity of the custom processor. Depending on the initial screen size and type of the minerals delivered, the first comminution stage is carried out by conventional jaw crusher or roller mill. A dry grinding process was carried out in all the plants visited. There was some preference for air swept ball mills and rod mills in closed circuit with air classifiers, for both coarse and micronizing grinds (micronized product is 100% passing 20 microns). At one site, Raymond hammer mills were being used in some units, in place of the ball mills. While wet grinding offers the lowest cost size reduction, the additional cost and plant requirement for drying the finished product and waste water discharge, discourages the use of that process route.

Although the air swept milling looks very similar to wet milling, all operators insist that they are using proprietary technology. At one site this proprietary technology included an interesting drive system using rubber belts rather than conventional gear rings, and a design of plant that allowed it to be easily cleaned should the need arise to process a different mineral. At a second site much of the proprietary nature of the technology appeared to relate to the development of automatic controls for the mills to permit one operator to run two or three mills simultaneously. At a third site automation was also an important component but blending and mixing were considered to be the important technological edge.

Some milling equipment is used to obtain specific aspect ratios or to allow mixing of surface treatment agents. Rod mills are preferred for high aspect ratio products such as wollastonite where the long particles can contribute to structural performance when used as a filler in plastics. Raymond mills were being used at one site to apply surface treatment reagents to the mineral at the same time as carrying out a particle size reduction.

Contamination of the processed mineral by grinding media wear product is minimized, when required, by using grinding media that have a similar chemical composition to the material being ground. At one site, the processing of a mineral product consisted of drying a flotation concentrate and the removal of tramp iron, and steel flakes from mill liners and grinding balls before further classification.

Some use was being made of high speed rotary attrition mills, such as the Atritor mill, for micronizing. These mills are a type of high speed pin mill that does some particle classification at the same time as comminuting. Opposing jet mills or fluid mills and vibrating mills were not seen at the plants visited. Lower wear and energy costs were described as reasons for preferring the ball or rod mill usage. While much was made of the technological edge that an operator might have, it appeared that good Canadian state-of-the-art practice would produce satisfactory results.

Normal operations were carried out at less than 100% of the capacity of the plant segment. This was in part due to the rate of production required by the client/customer and in part an intentional flexibility to accommodate surges in demand, adding flexibility to the warehousing function of the custom processor.

The costs of comminution relate to work index and final desired size. Below 10 microns, the energy inputs required to achieve progressively finer sizes follow an asymptotic curve. Wear and maintenance costs also climb steeply. Some examples of the range of costs that may be incurred are listed on the next page.

Table 4. NOTES ON COSTS

Operating costs:

Air swept ball mill (100 micron grind, soft rock)		$0.10 - $1.00 /t
Ceramic Powders 100% -5 microns (product rate 250 kg/hr)		$890 /t
Silicates for ceramics use (product rate 3 t/hr)		$55 /t
Atritor Mill energy budget		(@ $0.08/kwh)
Wollastonite (95% -40 micron)	75kwh/t	$ 6 /t
Calcite 50 micron average size	50kwh/t	$ 4 /t
Gypsum - 50 micron	20kwt/h	$ 1.60/t
Talc 95% -4 micron	22kwh/t	$ 1.76/t
10 micron average size	10kwh/t	$ 0.80/t
Kaolin drying	10kwh/t	$ 0.08/t

Maintenance costs:

Ball mill	$0.25 - $0.75/t
Atritor mill	$1.00 - $6.00/t

Surface Treatment reagent cost:
(eg silanes) 2% mix @ $30/kg $600/t

Bagging costs (manual) $8.00/t

Capital Costs:

Typical module with soft rock capacity of 25-40 tph to produce 50 micron size product. (Equipment costs only)

European Operator Estimate	$1 -2 million
Recent List Price Estimate (New, f.o.b. factory, U.S.A.)	$0.8 -1 million

Charges made by custom processors (depending on amount of processing) $20-300/t

Charges are calculated on a basis of:
operating cost + portion of amortization of all capital costs including land and equipment + margin (50-100%).

Operations (cont.)

In summary, the definition of costs, both capital and operating, are totally dependent upon the mineral being processed and the degree of comminution or surface treatment that may be required by the customer. Because the business is intensely competitive, it is not possible to derive a complete set of operating costs or charges, especially if a processor recognizes that there may be some risk that his figures may be quoted in a public document. The numbers on the previous page really serve to demonstrate the sort of range of cost and charge and should not be used as hard figures for financial analysis of a specific project.

Without a clear description of the type of processing that may be required, it is only possible to derive order of magnitude estimates of costs. If it were possible establish a similar sized operation in B.C. it would be reasonable to expect such a business to have revenues in the order of $1 - 15 million and employ between 25 and 70 persons.

5. INDUSTRIAL MINERALS - B.C. SOURCES

Developed sources of industrial minerals in British Columbia are limited in number and type at this time. Deposits that could supply to the type of custom processing plant that is found in Europe include Baymag Magnesite, Blue River Calcite, and some of the products such as calcium carbonate and dolomite produced by Imasco. Some of the analogue nepheline syenite and some felspar, olivine, perlite and silica deposits known may be sufficiently close to market specifications to permit direct processing.

The geology of the province allows good potential for the location of high grade talc, kaolin, wollastonite, barite and silica that might form feedstock for a further processing operation. Of these minerals, only barite and silica are now being produced or beneficiated in significant tonnages in B.C. Exploration of kaolin at Lang Bay north of the Sechelt peninsular, wollastonite on the Sechelt peninsular and talc near the Fraser canyon may result in some other feedstock in the shorter term.

The custom beneficiation of small parcels of rock containing industrial minerals does not make any economic sense because of the high cost of freighting gangue from a probably remote location and its subsequent disposal. Deposits of industrial minerals that require beneficiation are therefore only likely to contribute feed to a custom plant where further size reduction, blending and/or surface treatment may be needed for the beneficiated mineral.

The data base for industrial minerals in the province has been much improved in recent years, with the application of funds under the Canada - British Columbia Mineral Development Agreement. There is a need to continue this work and industry direction will be useful to focus on the areas deemed to have highest priority.

Because of the Pacific frontage of the province, we do have access to a wide variety of industrial minerals that are produced in countries which are at least perceived to be unable to supply consistent quality material in a timely fashion. It is worth exploring the concept of importing bulk shipments of high purity industrial minerals from countries such as China, India and Mexico, with a view to further processing, storage and transhipment under a label that may be perceived to reflect quality and reliability. Even if this is essentially a step in assisting the marketing of the offshore industrial mineral production, it would establish an international trading system that could serve future B.C. and other Canadian production.

6. INDUSTRIAL MINERALS - B.C. REQUIREMENTS/MARKETS

In the study prepared for the Ministry of Mines, titled, Industrial Minerals Marketing Studies Project, dated February 1987 a listing was made of the industrial minerals likely to be located in B.C. and their potential market and present import cost. This listing makes a useful starting point for considering which industrial minerals might be candidates for a B.C. custom processing plant. (It should be noted here that market sizes described in that listing were provisional and require further definition) A supporting approach is to consider which are the major industry sectors in B.C. and the Pacific Northwest and then look for the industrial minerals needs of those industries.

Because there is a net inflow of high value and manufactured goods into the province, there are large numbers of containers returning empty to Pacific Rim countries such as Japan, Taiwan and Korea. A parochial view of markets available to B.C. producers of industrial minerals might exclude those countries as possible markets for smaller parcels of value added product. With the potential for a low cost backhaul to the markets of California (population 25 million), Japan, Korea, Taiwan, and Singapore, those consumers should be given some consideration.

Delivery time across the Pacific would be approximately 14 days. While this far exceeds the European delivery times, only a few surface treated materials would have aging problems related to the delivery time. Container lots should be convenient to many consumers both for secure, uncontaminated transportation and for user site storage. Freight time to California, using truck back haul, should be in the order of two to three days, depending upon where the consumer is located within that state.

Container freight is currently used for several value added products of the metals mining industry in this province, such as cathode copper and high purity molybdenum disulphide. Containers offer the possibility of shipping pallet loads, Big Bags and pneumatic loaded bulk product in parcels that are convenient for many consumers.

The largest value industrial minerals imported into the Province are:

Silica (including finished container products and plate glass)

Talc (fine ground white for pitch control in pulp production)

Fluorspar (including derived chemicals such as AlF3)

Clays (structural and paper fillers)

Clays (absorbent/swelling)

A true custom milling facility will process those products supplied by producers or consumers, rather than minerals purchased by the processor. In starting up a greenfields plant, even a true custom miller will have to look for business like a trader of minerals who has to seek out and match both markets and sources of supply. In this context it is reasonable to make a list of industrial minerals that should be considered for a custom processing operation.

Industrial minerals included in the list should fit some of the following criteria:

a/ compatibility in a custom processing environment - eg all light coloured minerals or all dark coloured minerals.

b/ minerals that allow potential for high value adding, high energy consumption processing such as the surface treated fillers and superfine specialty ceramic powders for the engineered ceramics.

c/ Minerals that are or could be derived from B.C. sources.

d/ Minerals that are substitutes or complement c/ above.

e/ Minerals that are consumed in substantial amounts in B.C. and the contiguous provinces and states.

f/ Minerals that have good growth potential in international markets, particularly Pacific Rim markets.

Table 5. LISTING OF INDUSTRIAL MINERALS FOR CUSTOM PROCESSING

MINERAL	CRITERIA MET
Group I	
Talc	a,b,c,E,f,
Wollastonite	a,b,c,d,(e),F
Magnesite	a,b,C,e,F
Caustic Magnesia	a,b,C,(e),
Calcite	a,C,e,f
Dolomite	a,C,e,
Gypsum	a,C,e,
Bentonite	a,b,c,d,e,
Kaolin	a,b,c,d,F
Calcined Bauxite	a,(e),
Silica/Quartzite	a,B,C,e,F
Nepheline syenite	a,C,d,e,
Feldspar	a,C,d,e,
Pyrophyllite	a,c,d,
Kyanite	a,(c),d,f,
Barite	a,c,d,e,
Mica	a,b,c,d,e,f,
Perlite	a,b,C,d,e,
Alunite	a,c,
Zeolite	a,c,(e),
Fluorspar	a,c,e,f,
Zirconia	a,b,(c),F,
Titania	(a),b,(c),d,e,f,
Group II	
Olivine	a,c,d,e,
Chromite	a,c,d,e,
Garnet	a,c,e,
Magnetite	a,c,e,
Hematite	a,c,
Slag	a,c,d,e,

Upper case indicates significant criterion
() indicates minor criterion

7. GOVERNMENT SUPPORT -INFORMATION/INFRASTRUCTURE

Regional development assistance to establish a custom processing facility for industrial minerals will be best delivered if both the private sector and the development agency fully understand the potentials and limitations of such an operation. There is still a need to stimulate interest on the part of industry in such a project through the continuing efforts of the Geological Survey Branch and the Mineral Policy Branch of the Ministry of Energy, Mines and Petroleum Resources. The level of interest in industrial minerals in this province is much higher today than in past years because of their effective delivery of information.

No custom processing facility will be built by industry in B.C. unless the participants are reasonably confident of a successful outcome., Substantial changes in taxation, energy costs, and operating regulation, or the perception that those changes may be made in the near future, would be a great incentive to take the concept and do the project in Puget Sound.

A major obstacle to establishing the project within the Port of Vancouver may be the high cost of longshoring services that are in effect. One current user of those services is paying a $1200 charge for a 20 ton container loaded with pallets in the Port of Vancouver and delivered to Japan. When containers currently cost between $1300 and $2500 to purchase outright and one man can load a container in less than an hour with a fork lift truck, it appears that costs can be excessively high. It may be less expensive to send product through the Ports of Bellingham or Seattle at this time, even with the additional cost of truck transport to B.C. It is possible that there are some anomalies in cost in the Port of Vancouver that can be ameliorated with government intervention.

8. THE B.C. CUSTOM PROCESSING PLANT

The establishment of a custom processing plant for industrial minerals in the province will not assist many potential producers of industrial minerals to commence production. There are very few situations within the province that would be able to interact with such a plant at this time. In an overview of the European processors, it becomes evident that the custom producer is there because of market opportunity. A new operation must therefore expect to face a period of market acquisition, much like a new industrial minerals supplier. Indeed the very justification of a new operation must be the perception that that market can be acquired.

A base load of one or more minerals will have to be selected to cover the initial capital and fixed operating costs. An example of such a base load might include Chinese talc and Indian wollastonite. The talc would potentially find some market share in the pitch control use of talc in the pulp and newsprint mills in the Province. The ground and surface treated wollastonite would have sufficient value for returning across the Pacific to be used as a structural filler in engineered plastics.

It is possible that the base load requirement is at least partially satisfied in some of the existing industrial minerals processing plants in the Lower Mainland. Companies such as Pacific Perlite, Texada Lime and Imasco might have plant capacity or site availability for establishing a custom processing plant. The production sites of Canada Cement LaFarge and Tilbury Cement on the Fraser river also might have potential for additional development in a business segment that is generally related to the principal business of those companies.

The location of the plant should be near a point of deep sea freight discharge and close to rail and arterial highway links. A Port of Vancouver location would be much preferred over Prince Rupert, Squamish or Vancouver Island because of the better land transportation links. The plant would not have more environmental impact than industry already sited in the industrial zones flanking the Fraser River. Good plant practice will require close control of dust produced by the processing and waste management should not create any special problems because of the generally low toxicity of most industrial minerals.

The capital cost of the initial plant would be in the order of $2,000,000 for a capacity that would be considerably in excess of requirements for the first years of operation. Employment would probably not exceed 10 persons during the start up period.

- It should be possible for a well motivated group with Pacific Rim trading experience, perhaps in joint venture with an established mill operator such as a metal mining company, to intitiate an operation of warehousing, processing and packaging industrial minerals here in the province. Several mining and industrial minerals companies in the province have the ability and the necessary corporate attitudes to undertake such a project.

Each of the European custom processors visited expressed initial interest in participation in a joint venture, particularly if the technology transfer would give them some leverage. The concept of a custom processing facility, based on imported bulk minerals and reshipment to the Pacific Rim as packaged, value added products, was considered by them to have some potential for success. Interest has been expressed by at least one U.S. company in participation in a similar project in eastern Canada. It would be useful to approach some of the U.S. processors to determine if there would be any interest amongst them for a B.C. based plant.

9. Ackowledgements

The writer wishes to acknowledge with thanks the cooperative assistance of all those indicated on the Contact List attached to this study and, in particular, the industry representatives, who gave freely of time and information.

10. Some Custom Processors

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England. tel:606 553151 fax:0606 593008
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Hopton Minerals Ltd Brassington nr.Wirksworth, Derby, DE4 4ES
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Micro Milling Gorsey Lane, Widnes,Cheshire WA8 0RP,
England. tel:051 424 5708 telex:628684MICMIL G.

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H.J.Schmidt Neuwied POB 2168 . D-5450 Neuwied, Germany
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Custom Milling and Supply
746 Everett Ave., Salt Lake City, UT 84116
tel: 801 359 3234

Dar-Tech Inc 4900 Lakeside Ave., Cleveland, OH 44114
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11. CONTACT LIST

(Listing of persons who assisted in discussions and/or who have been involved at some stage with developing and or studying the concept of custom processing of industrial minerals)

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Workshop Notes: Production of High-Value Industrial Minerals and Ceramic Powders - Seizing the Opportunity.

J-Y.Tremblay, G.Feasby, M.Boucher, 1989 Regional Custom Processing of Industrial Minerals, Internal EMR Report.

Western Mine Engineering, 1989 Mining Cost Service, Spokane, Washington.